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INFORMATION FROM FOREIGN DOCUMENTS OR RADIO BROADCASTS REPORT



COUNTRY

DATE OF

CD NO.

INFORMATION 1949

SUBJECT

Scientific - Engineering, internal combustion

HOW

PUBLISHED

Periodical

DATE DIST. 27 Sep 1950

WHERE **PUBLISHED**

Moscov

NO. OF PAGES

50X1-HUM

DATE

PUBLISHED

Dec 1949

SUPPLEMENT TO

REPORT NO.

LANGUAGE

Russian

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Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnicheskikh Nauk, No 12, 1949.

> INTRODUCTION AND TABLE OF CONTENTS FOR THE ARTICLE, "THE INFLUENCE OF CHEMICAL AND TURBULENT FACTORS ON THE COMBUSTION PROCESS UNDER MOTOR CONDITIONS

(Read at the Institute of Chemical Physics, Academy of Sciences USSR, April 1949)

A. S. Sokelik, A. N. Voinov, Yu. B. Sviridov Presented by Academician N. N. Semenov

The first observations on the combustion process in an engine with spark ignition had already led to the conclusion that the development of combustion in such engines is determined by the propagation of the flame front that arises around the spark source (or sources) in ignition.

Well known is the concert concerning the separation of the combustion process into two phases that differ radically with respect to the mechanism of flame propagation. According to these ideas, the speed of flame propagation in the first phase (from the moment of ignition to a notable increase in pressure) is determined merely by the physicochemical properties of the mixture (namely, the properties of the fuel, the mixture's composition, the temperature and pressure of the charge, etc.). On the other hard, in the second phase of combustion, which corresponds to the main part of the indicator diagram (i.e., the phase where most of the energy is released), the combustion process is controlled only by so-called mechanical factors and is not dependent on the physicochemical properties of the mixture. However, this point of view not only has not been further developed, but has had no effect on all subsequent investigations of processes in engines.

The fact that the average speed of flame propagation in an engine -- the speed determining the general duration of the process -- increases tens of times the main flame speed for suitable fuel-air mixtures was explained long ago by the action of the swirling (eddy, vortical action, turbulence) of the charge on the combustion procese in an engine.

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Obviously, Ricardo's experiment is a unique experiment set up to prove the differences between initial and main phases of combustion in an engine; according to his experiment, a variation in the velocity state of the engine influences only the duration of the main phase and leaves the duration of the first phase unchanged. But, as we shall see, the arrangement followed in Ricardo's experiment involved a theoretical error (error in principle) which deprives this experiment of its worth. Regrettably enough, later research also lacked data that could permit solution of the problem concerning the reality of the separation of the combustion process in an engine into phases with mechanisms that differ in principle.

At the basis of all research of this type there are, along with the individual errors in procedure and method, two general defects in principle: either the combustion process is considered as a whole; or, in a comparison of the course of combustion in the individual phases, the constancy of the physicochemical and gasdynamical conditions is not guaranteed. (In the experiments of Bouchard, et al., the preheating of the mixture at the intake was absent and thus there was no assurance of the conditions necessary for the volatization of the fuel and mixture-formation.) For example, the performance of the experiments for various mixture compositions, fuels, RPM, etc., for constant "ignition-advance" provides for comparable physical conditions only for the initial phase of combustion (or burning), and makes the gas-dynamical conditions completely incomparable for combustion in the main phase, since its beginning ("origin") must exist at different points as the states of the charge changes in motion.

Therefore, the investigation of combustion speed in the separate individual phases of a process which holds special interest for us is that in which constant physicochemical and gas-dynamical conditions might be assured. Such an investigation is the main problem of this article.

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